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## EXERCISES.

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A SOLID sphere and a solid cylinder of equal radii roll from rest down the same inclined plane ; compare the times of their descent.

[*Artemas Martin.*]

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PROVE that, in Weierstrass's notation,

$$\sigma u \sigma_3 v \sigma_2 w + \sigma_3 u \sigma v \sigma_1 w + \sigma_2 u \sigma_1 v \sigma w = 0 ,$$

where  $u + v + w = 0$ .

[*Frank Morley.*]

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LAGRANGE'S interpolation formula is

$$f_x = \sum^n A_n f a_r + (-1)^n (x - a_1) \dots (x - a_n) \frac{f^n(u)}{n!} ,$$

wherein  $u$  is some value of  $x$  which lies between the greatest and least of the values  $x, a_1, \dots, a_n$ , and  $f^n(u)$  means that  $f_x$  is to be differentiated  $n$  times and in the result  $u$  put in the place of  $x$ ; and

$$A_r = \prod \frac{(x - a_i)}{(a_r - a_i)} . \quad (i = 1, \dots, r-1, r+1, \dots, n)$$

If  $a_r = a^r x$ , we have

$$f_x + \sum_1^n A_r f a^r x = (a-1) \dots (a^n-1) \frac{x^n}{n!} f^n(u) ,$$

$$A_r = (-1)^r \frac{a^r (1 - a^{-(n-r+1)}) \dots (1 - a^{-n})}{(a-1) \dots (a^r-1)} .$$

Interpret this result when  $a$  lies between  $+1$  and  $-1$ , and also when  $a^2 > 1$  and  $n = \infty$ .

[*W. H. Echols.*]

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REQUIRED the locus of the point in the normal to a conic, which is equally distant from the focus and the foot of the normal.

[*Geo. R. Dean.*]